



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
17.02.2010 Bulletin 2010/07

(51) Int Cl.:
F04C 2/16 (2006.01) F04C 15/00 (2006.01)

(21) Application number: **09010090.0**

(22) Date of filing: **05.08.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR
Designated Extension States:
AL BA RS

(71) Applicant: **Settima Flow Mechanisms Srl.**
Gossolengo (PC) (IT)

(72) Inventor: **Lavezzi, Umberto**
Gossolengo (PC) (IT)

(74) Representative: **Paglia, Pietro**
Botti & Ferrari S.r.l.
Piazza dei Martiri 5
40121 Bologna (BO) (IT)

(30) Priority: **12.08.2008 IT BO20080522**

(54) **Gear pump**

(57) The present invention regards a positive displacement rotary gear pump (1) of the reversible type, i.e. one that is able to operate in both rotational directions, with inversion of suction and delivery, without loss of yield. More particularly the pump (1) of the present invention regards a pair of meshing toothed wheels (3,4) comprising shafts (32,42) supported by bushes (9,10) in abutment on the rear cover (8), said rear cover (8) comprising a first chamber (11) placed in fluid communication

with a first opening (5) and a second chamber (12) placed in fluid communication with a second opening (6), and a third chamber (13a,13b) selectively placed in fluid communication alternatively with said first (11) or with said second (12) chamber, said chambers (11,12,13a,13b) being arranged at the abutment surface of said bushes (9,10) against said cover (8), the openings (5,6) alternatively carrying out the function of suction or delivery opening.

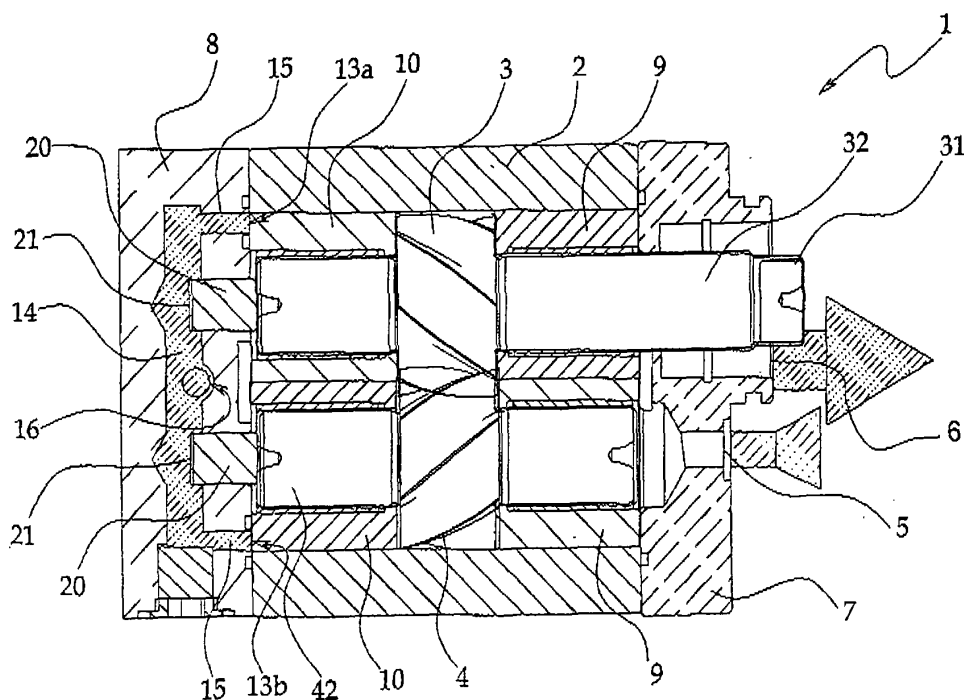


FIG.4

Description

Field of application

[0001] The present invention refers to a positive displacement rotary gear pump.

[0002] More particularly the present invention refers to a positive displacement pump of the reversible type, i.e. one that is able to operate in both rotational directions, with inversion of suction and delivery, without loss of yield.

[0003] Positive displacement rotary gear pumps are used in various industrial sectors, where they transfer mechanical energy to a fluid operator that is intended to engage mechanical actuators such as linear hydraulic jacks.

Prior art

[0004] Gear pumps commonly consist of a pump body, comprising an inlet and outlet for suction and delivery, which house two toothed wheels that mesh with each other, supported by apposite bushes. Usually one of the two wheels, called the drive wheel or pinion and made to rotate by means of an external motor, engages in rotation the other wheel, which is called the driven wheel.

[0005] During the rotation the compartments that are present between two concatenated or consecutive teeth of each of the toothed wheels, generate a volume and thereby aspirate a fluid, usually oil, coming from the suction opening, and conduct it laterally along the inner wall of the pump body towards the delivery opening. The tight sealing preventing reflux from delivery to suction is assured by the pair of interlocking teeth of the two wheels and the low level of leeway between the head of the tooth and the pump body's wall.

[0006] When pumps of this kind are used for high-pressured delivery, it happens that the meshing wheels, when they are helical, generate an axial push that is unloaded on the posterior cover, called the hood, and on the anterior one, called the flange.

[0007] This phenomenon of axial push, which is ideally nonexistent in pumps with straight-toothed gears, becomes relevant in pumps with gears with helical teeth, where the meshing between the toothed wheels is caused by the mechanical axial push, and to which the hydrostatic forces from the fluid under pressure are added.

[0008] This axial push involves a slow and inexorable wear and tear of the lateral faces of the toothed wheels and the support bushes, and consequently a loss of sealing between delivery and suction and therefore over time causing a considerable decrease in overall performance.

[0009] In order to overcome these inconveniences the pump may be configured in such a way that an axially pushing force is created that is opposed to the one generated by the rotating toothed wheels.

[0010] In particular, from the rear cover the shafts of

the two wheels are made to rest on two abutment pins that are mounted in an axially slidable and sealing manner between the respective housings on the rear cover itself or on an appropriate intermediate plate.

[0011] The ends of the backing pins opposite the shafts flank a shared chamber located on the rear cover and placed in communication with the delivery outlet of the pump. In this manner the fluid under delivery pressure that comes to occupy this chamber, exercises a direct pressure on the two pins, pressing them contrary to the axial push generated by the rotating toothed wheels. In addition, also the bushes proximal to the rear cover are with their annular profiles in correspondence with said chamber, so that they too are exposed to the pressure exercised by the fluid under delivery pressure.

[0012] To sum up, in the prior art the fluid under delivery pressure that is present in the chamber on the rear cover of the pump is used to counter the axial push from the rotation of the toothed wheels.

[0013] To obtain an effective force to counter the axial push from the rotation of the wheels that is sufficient and distributed enough to create a balanced system, it is necessary that the pressure exerted by the delivery fluid in the chamber acts on a surface of the bushes that is proportional to the corresponding area under pressure on the other side of the bushes.

[0014] To that end the chamber, in communication with the delivery outlet, is commonly made with an omega conformation obtained in correspondence with the internal part of the external edge of the bushes, whose external profile is substantially shaped like a figure "eight". This omega-shaped configuration of the chambers placed in communication with the delivery outlet, allows one to have a surface extension that is adequate and greater than that of the common further chamber, usually a small channel placed in communication with the suction inlet and therefore reached by the suction fluid that is definitely pressurized less than that of the delivery.

[0015] Although this configuration allows for optimal operation each time the chamber with the greater extension (the omega-shaped chamber) is in communication with the delivery outlet and the small channel with the suction inlet, this configuration is unsuitable, however, whenever it is necessary to invert the use of the pump, i.e. to invert the function of the suction inlet and delivery outlet.

[0016] In fact, by inverting the direction of rotation of the toothed wheels the omega-shaped chamber having a larger extension will be filled with pressurized suction fluid, whereas the small channel will be filled with pressurized delivery fluid (higher than that of the suction fluid).

[0017] This means that the two pushing pins of the shafts of the toothed wheels and the two bushes that are proximal to the rear cover, are no longer exposed to the pressure of the pressurized delivery fluid from the omega-shaped chamber, but to that of the pressurized suction fluid, which, being much lower than that of the delivery, is insufficient to counter the axial push due to the

rotation of the toothed wheels.

[0018] In brief, with an inversion of the direction of rotation one loses the equilibrium obtained with the previous rotational direction, with a resultant noticeable loss of performance of the pump.

[0019] In other words, gear pumps known from prior art are not very suitable to be used in a reversible manner, i.e. in such a manner that the functions of the suction inlet and delivery outlet can be inverted.

[0020] Positive displacement pumps of the reversible kind are known that produce an acceptable output in both rotational directions, but this reversability is obtained by means of solutions that appear to be fairly complex and expensive.

Summary of the invention

[0021] There exists, therefore, a noted need for a positive displacement rotary gear pump that is able to function with high performance in both directions, guaranteeing great versatility in application and at the same time an ease of use that is comparable to pumps known from the prior art that are able to function optimally in only a single direction, within the field of a constructive solution that is simple and rational and that requires small constructive modifications to prior art pumps of high performance in a single direction.

[0022] The object of the present invention is providing a positive displacement rotary gear pump having structural and functional characteristics that meet with the abovementioned requirements and that at the same time overcome the inconveniences described above with reference to the prior art.

[0023] This goal is obtained by means of a positive displacement rotary gear pump as described in claim 1.

[0024] The dependent claims describe preferred and particularly advantageous embodiments of the pump according to the invention.

[0025] Further characteristics and advantages of the invention will become evident from the following description, provided by way of non-restrictive example, with reference to the Figures in the attached illustrations, wherein:

Brief description of the drawings

[0026]

- Figure 1 shows a perspective view of a pump according to the present invention;
- Figure 2 shows a side view of the pump in Figure 1;
- Figure 3 shows a front view of the pump in Figure 1;
- Figure 4 shows a cross section on a vertical plane along the line IV-IV of Figure 3;
- Figure 5 shows a cross section on a horizontal plane along the line V-V of Figure 3;
- Figures 6, 7 and 8 show a cross section on a vertical plane along the lines VI-VI, VII-VII and VIII-VIII of

Figure 2.

Method for reproducing the invention

[0027] Referring specifically to Figures 1-5, 1 generally denotes a positive displacement rotary gear pump according to the present invention.

[0028] The pump 1 comprises generally speaking a pump body 2 which internally houses a toothed driving wheel 3 and a toothed driven wheel 4 (Fig.4).

[0029] In the illustrated example the toothed wheels 3,4 are of the cylindrical kind with helical teeth, but naturally the invention can be applied also in cases where different wheel types are used, e.g. with cylindrical gears with straight teeth.

[0030] The pump body 2 is provided with a first opening 5 and a second opening 6, that alternately function as suction inlet or delivery outlet, according to the direction of rotation of the toothed wheels 3, 4, i.e. functioning according to the direction of rotation transferred by a motor, not illustrated, to the driving wheel 3. The Figures illustrate a structure that allows for the obtainment of a principal functioning in which the first and the second opening 5 and 6 respectively function as suction inlet and delivery outlet.

[0031] On the sides of the pump body 2 a front cover 7 and a rear cover 8 respectively, the latter also called the hood, are fastened with regular fastening means such as screws.

[0032] In the example the openings for suction and delivery 5, 6 are axially obtained on the front cover 7, but of course any other collocation may be adopted, such as placed opposite each other on the pump body 2.

[0033] The extremity 31 of the shaft 32 of the drive wheel 3 to be attached to the pump's motor drive shaft passes through and protrudes from the front cover 7.

[0034] Inside the pump body 2 the shafts 32 and 42, of the drive wheel 3 and the driven wheel 4 respectively, are supported by two pairs of bushes 9, 10 that we will call front and back respectively (Fig. 4). In the example each pair of bushes 9, 10 is formed by two separate elements, but it is also possible that each pair of bushes is made as a single piece.

[0035] According to the present invention the two rear bushes 10 rest against the rear cover 8 on which there are a first, a second and a third chamber that will be better described further on (Fig. 7).

[0036] In particular the first chamber, indicated by 11, is in communication by means of a central appendix 11a with the interior of the pump body 2 in the area reached by the fluid that comes through the first opening 5, in correspondence to the suction inlet in the illustrated example. The second chamber 12 is in communication by means of a central appendix 12a, with the interior of the pump body 2 in the area reached by the fluid that comes through the second opening 6, in correspondence to the delivery outlet in the illustrated example. In practice the first chamber 11 communicates with the first opening 5

and the second chamber communicates with the second opening 6. The third chamber is concretized in two distinct opposite areas 13a and 13b and interconnected by a connection duct 14 closed at the ends and located in the rear cover 8. This connection is created by two parallel lines 15 that run from the connection duct 14 and that lead centrally into the two areas 13a and 13b (Fig. 4).

[0037] The connection duct 14 is placed selectively in fluid communication with the first chamber 11 or the second chamber 12 by means of a first transverse duct 16 that is closed at the ends by two caps 22 that are accessible from the outside, and from which two parallel lines 17 run that lead into the first and second chamber 11, 12 at a respective central hole in the appendices 11a, 12a (Fig. 5).

[0038] In the example embodiment illustrated here, provided by way of non-restrictive indication, both the connection duct 14 and the first duct 16 are located inside the rear cover 8 where they cross centrally, forming a crossed configuration.

[0039] In order to fluidly connect in a selective manner the connection duct 14 with the first chamber 11 or the second chamber 12 so that the two areas 13a, 13b are connected exclusively with either the first chamber 11 or the second chamber 12, the use of interception means is provided which in the example take the form of a shutter body 18 inside the first duct 16.

[0040] In particular said shutter body 18 has a cylindrical configuration with a variable cross-section and mounted in an axially floating manner inside the first duct 16.

[0041] More particularly the shutter body 18 is made of a single piece of three cylindrical elements, of which the central one 18a has a larger cross-section, and the two lateral elements 18b, identical in the example, are also cylindrical but with smaller cross-sections. The dimensions of the cylindrical elements 18a, 18b are chosen specifically to allow for the possibility of interruption of the communication between the central element 18a with the larger cross-section and one of the two chambers 11 or 12. In the example the diameter of the central element 18a is close to the internal diameter of the duct 16 within which it slides.

[0042] The interruption of the connection occurs when the central element 18a with the larger diameter is moved, always on the inside of the first duct 16, along one of the lines 17 (to obstruct it) that lead to the first chamber 11 and the second chamber 12, leaving open the remaining line 17 and as a result creating a unique connection with either the first chambers 11 or the second chamber 12.

[0043] The movement of the shutter body 18 inside the duct 16 is controlled by the difference in pressure between the delivery and the suction, which in practice corresponds to a pressure difference between the first chamber 11 and the second chamber 12.

[0044] Basically the shutter body 18 allows the two areas 13a, 13b of the third chamber to be placed in unique

communication with only one of either the first chamber 11 or the second chamber 12, the one with the fluid that is pressurized the most, i.e. that chamber that is in communication with the opening that serves as delivery outlet. This is due to the fact that the shutter body 18, pushed by the pressure of the delivery fluid that reaches the first duct 16 through one of the two lines 17, interrupts the communication with the chamber with the fluid with the suction pressure, with is lower than that of delivery.

[0045] In other words, the shutter body 18 functions as an isolator between the chamber (denoted by 11 in the example) placed under suction pressure and the first duct 16.

[0046] The chambers 11, 12, 13a, 13b obtained on the rear cover 8, are arranged in correspondence to the rear faces of the rear bushes 10 that rest directly on the rear cover itself.

[0047] In practice the annular profile of the rear faces of the rear bushes 10 will be positioned in correspondence with the three chambers 11, 12, 13a, 13b that are arranged along a tract that substantially replicates the profile of the bushes themselves, but nevertheless remaining within the external perimeter of these, denoted by a dashed line in figure 7.

[0048] In the example the first chamber 11 and the second chamber 12 are identical and arranged opposite each other, just as the two areas 13a, 13b are identical and arranged opposite each other. This should not be interpreted, however, as limiting the rights of the applicant, inasmuch as the relative arrangement of the above-mentioned chambers could be different for constructive reasons.

[0049] In the example the three chambers 11, 12, 13a, 13b are confined by the grooves on the rear cover 8 and separated by a seal 19, opportunely located inside a shaped groove, to prevent the fluid under high pressure from seeping through to the chamber (either the first or the second) with the lower pressure.

[0050] It should be remembered that, although the first chamber 11 and the second chamber 12 are completely covered by the rear bushes 10, they are nevertheless placed in communication with respectively the delivery outlet and the suction inlet, or vice versa. In the example this is obtained by shaping the chambers 11 and 12 in such a way that they have respective central appendices 11a, 12a, that are not covered by the rear bushes 10 but project from the external perimeter defined by these so that they are placed directly in communication with respectively the first opening 5 and the second opening 6, as shown in Figures 7 and 8.

[0051] Operationally, when the pump 1 is activated with the first opening 5 used for suction and the second opening 6 used for delivery, the fluid, usually oil, is aspirated through the first opening 5 and delivered through the second opening 6.

[0052] The second chamber 12, which communicates with the second opening 6 through the appendix 12a, is reached by the high pressurized oil, whereas the first

chamber 11, which communicates with the first opening 5 through the appendix 11a, is reached by low pressurized oil. The high pressurized oil in the second chamber 12 pushes the shutter body 18 that is present in the first duct 16 so that it interrupts the connection between the first chamber 11 (with low pressure) and the duct 16 itself.

[0053] In this position the fluid acts against the shutter body 18, bringing it in abutment against one of the two closing caps 22 of the duct 16 (Figs. 5, 6). In this position the central element 18a blocks the passage of the fluid between the duct 16 itself and the line 17 that leads to the first chamber 11 (Fig. 5).

[0054] At this point the oil under delivery pressure passes through the part of the duct 16 that is left open by the shutter body 18, and reaches the second duct 14 from which, by means of line 15, it reaches the two areas 13a and 13b (Fig. 4).

[0055] In this manner the oil under delivery pressure is present both in the second chamber 12 and in the two areas 13a and 13b of the third chamber. Thanks to this lay-out the forces that are exerted by the pressurized oil act against the face of the rear bushes 10 in contrast to the axial force that is generated by the toothed wheels 3, 4.

[0056] By reversing the operational direction the second opening 6 will be placed in suction whereas the first opening will be placed in delivery. The cylindrical body 18 is pushed by the force of the oil from the other side of the one of the previous operational configuration, to shut off the connection between the duct 16 and the second chamber 12, placing in communication the two areas 13a and 13b with the first chamber 11 which contains oil under delivery pressure (position not illustrated).

[0057] In practice the shutter body 18 isolates the duct 16 from the chamber that is in direct communication with the fluid at suction pressure, and places it in exclusive communication with the chamber that is in direct communication with the fluid at delivery pressure. The second duct 14, which is centrally in communication with the duct 16, is traversed all along its extension by the fluid under delivery pressure that arrives from the portion of the duct 16 that is left open by the shutter body 18. From the duct 14 the fluid reaches, by means of lines 15, the two areas 13a and 13b, in order to fill these with high pressure fluid.

[0058] In other words the two areas 13a and 13b are always placed in communication with the chamber that is in direct contact with the fluid that is under delivery pressure, and as a result always communicate with the opening that functions as the delivery outlet.

[0059] In this manner the overall area occupied by the fluid under delivery pressure that acts in contrast to the axial push generated by the rotation of the toothed wheels, comprises one of the two first 11 and second 12 chambers (dependent on the rotational direction), as well as the two areas 13a and 13b of the third chamber, thus creating always the same overall surface (when the first and the second chamber are identical, as they are in the example), independent from the pump's direction of ro-

tation.

[0060] This determines an axial push in contrast to the opposed axial push generated by the rotation of the toothed wheels, which assures an equal and elevated performance of the pump in both rotational directions.

[0061] In accordance with the preferred embodiment of the present invention, from the rear cover 8 the shafts 32, 42 rest on a pair of respective abutment means 20 that are mounted in an axially slidable and sealing manner between the respective housings 21 on the rear cover 8. The bases of these housings 21 are placed in communication with the connection duct 14 in order to be reached by the fluid under delivery pressure, so that the means 20 are pushed to counter the push generated by the rotation of the toothed wheels 3, 4.

[0062] This pressure on the abutment means 20, together with the force generated by the pressurized fluid that is present in the chamber communicating with the delivery outlet (either the first or the second chamber) and the areas 13a, 13b of the third chamber which is exerted directly onto the rear bushes 10, contribute to keeping the combination of toothed wheels 3, 4 and the pairs of bushes 9, 10 in abutment against the reference plane that is created by the face of the front cover 7 directed towards the interior of the pump body 2.

[0063] In the present invention, the terms high pressure and low pressure are intended to mean delivery pressure and suction pressure respectively.

[0064] As may be understood from this description, the positive displacement rotary gear pump according to the present invention meets with the demands and overcomes the disadvantages described in the introductory part of this description with reference to the prior art.

[0065] As a matter of fact, the positive displacement rotary gear pump according to the present invention performs with a high yield in both rotational directions of the toothed wheels.

[0066] Moreover, this pump does not need to be supplemented by any device in order to function correctly in both rotational directions, which makes inversion of rotation by the user extremely easy.

[0067] Lastly the wear and tear of the internal components of the pump, particularly of the toothed wheels and the bushes, is in no way influenced by any possible continuous and sudden changes of direction of the rotation of the toothed wheels.

[0068] Obviously the positive displacement rotary gear pump as described above is amenable to numerous modifications and variations by someone skilled in the art to meet with specific and contingent demands, but these nevertheless fall within the scope of protection of the invention, which is defined by the following claims.

[0069] By way of example it is possible to place between the rear cover 8 and the pump body 2 a plate which contains the chambers 11, 12, 13a, 13b and the housings 21 for the abutment means 20.

Claims

1. Positive displacement rotary gear pump comprising a pair of meshing gear wheels (3,4), respectively driving and driven, enclosed inside a pump body (2) closed by opposite axial seal covers, respectively front (7) and rear (8), and provided with a first opening (5) and a second opening (6), said wheels (3,4) comprising respective shafts (32,42) supported by bushes (9,10) in abutment on the rear cover (8) and on the front cover (7) and subjected in use to pressures which determine an axial thrust, said rear cover (8) comprising a first chamber (11) placed in fluid communication with said first opening (5) and a second chamber (12) placed in fluid communication with said second opening (6), said first (11) and second (12) chambers being isolated from each other, **characterised in that** said rear cover (8) further comprises a third chamber (13a,13b) selectively placed in fluid communication, by means of interception means (18), alternatively with said first (11) or with said second (12) chamber, said chambers (11,12,13a,13b) being arranged at the abutment surface of at least one of said bushes (9,10) against said cover (8), the openings (5,6) alternatively carrying out the function of suction or delivery opening.
2. Pump according to claim 1, wherein said wheels (3,4) have helical toothings.
3. Pump according to claim 1 or 2, wherein said third chamber (13a,13b) is in communication with that chamber chosen from among said first (11) and said second (12) chamber communicating with the opening (5,6) which in use carries out the function of delivery opening, it being crossed by fluid at the delivery pressure.
4. Pump according to any one of the preceding claims, wherein said chambers (11,12,13a,13b) are arranged on said rear cover (8) at the faces of the bushes (10) which abut directly on the rear cover (8) itself, said bushes (10) sustaining an axial thrust in use, opposing the thrust generated by the gear wheels (3,4) in rotation, generated by the fluid under pressure present in said third chamber (13a,13b) and in one from among said first (11) and second (12) chambers communicating with the opening (5,6) which in use carries out the function of delivery opening.
5. Pump according to any one of the preceding claims, wherein said first (11) and said second (12) chambers are identical and symmetrically arranged with respect to a symmetry axis.
6. Pump according to any one of the preceding claims, wherein said third chamber comprises two opposing zones (13a,13b) having an identical surface.
7. Pump according to claim 6, wherein said zones (13a, 13b) of the third chamber are interposed between said first (11) and said second (12) chamber.
8. Pump according to any one of the preceding claims, wherein said chambers (11,12,13a,13b) are confined within grooves made on said rear cover (8) and separated by seals (19).
9. Pump according to any one of the preceding claims, wherein said interception means comprise a shutter body (18) directly actuated by the pressure difference present between the first (11) and the second (12) chamber, when the pump is in use.
10. Pump according to claim 9, wherein said shutter body (18) is arranged inside a first duct (16) placed in communication with said first (11) and second (12) chamber.
11. Pump according to claim 10, wherein said shutter body (18) has a cylindrical configuration with variable section, mounted axially floating inside said first duct (16).
12. Pump according to any one of the preceding claims, wherein said third chamber (13a,13b) is in communication through a second duct (14) made in said rear cover (8) and placed in fluid communication with said first duct (16), said interception means (16) alternatively isolating said first (11) or said second (12) chamber from said first duct (16).
13. Pump according to claim 12, furthermore comprising abutment means (20) on which the shafts (32,42) of said gear wheels (3,4) lie in abutment, said abutment means (20) being placed in communication with said second duct (14) so to be subjected, when the pump is in use, to an axial thrust generated by the pressurised fluid present in said second duct (14) and adapted to oppose the thrust generated by the rotation of the gear wheels (3,4).
14. Pump according to claim 13, wherein said abutment means comprise pins (20) mounted axially sliding and scaled within respective housings (21) made on said rear cover (8).

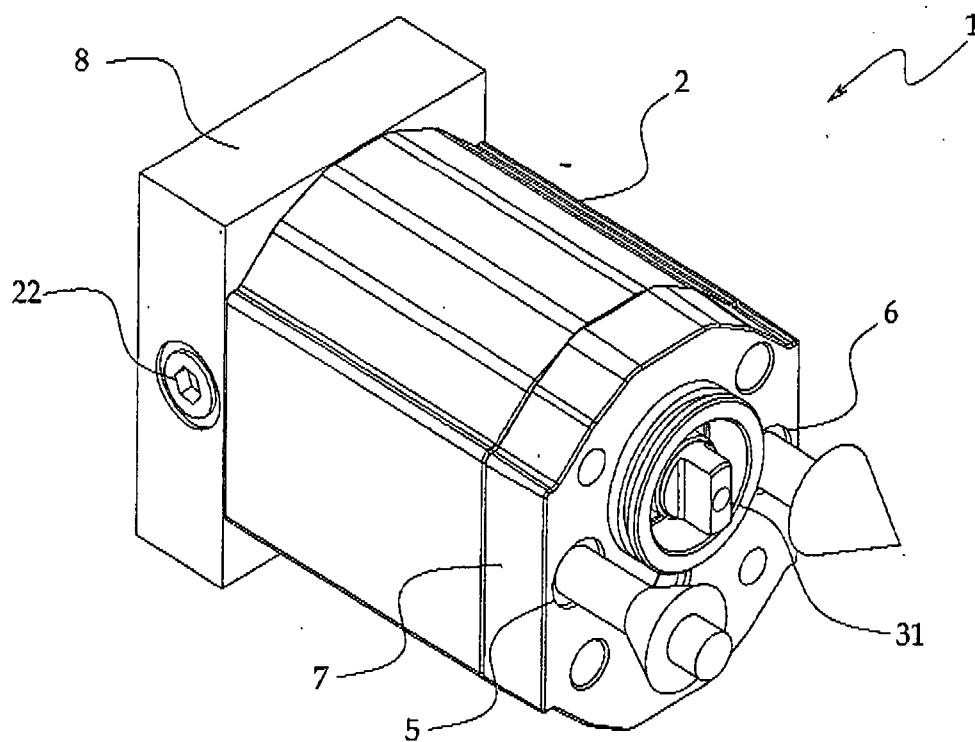


FIG.1

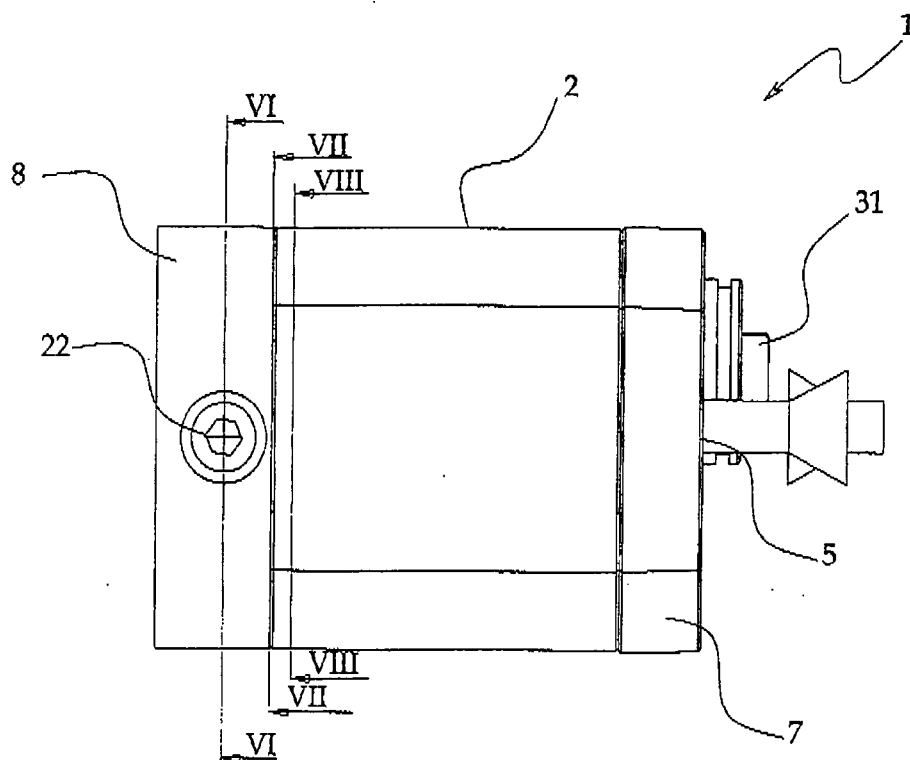


FIG.2

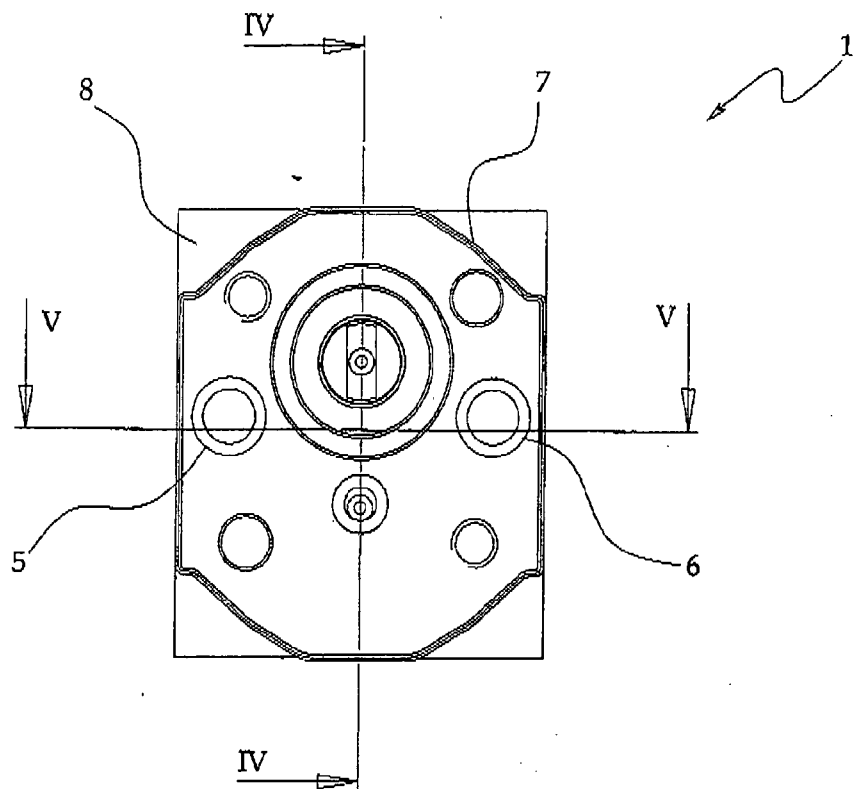


FIG.3

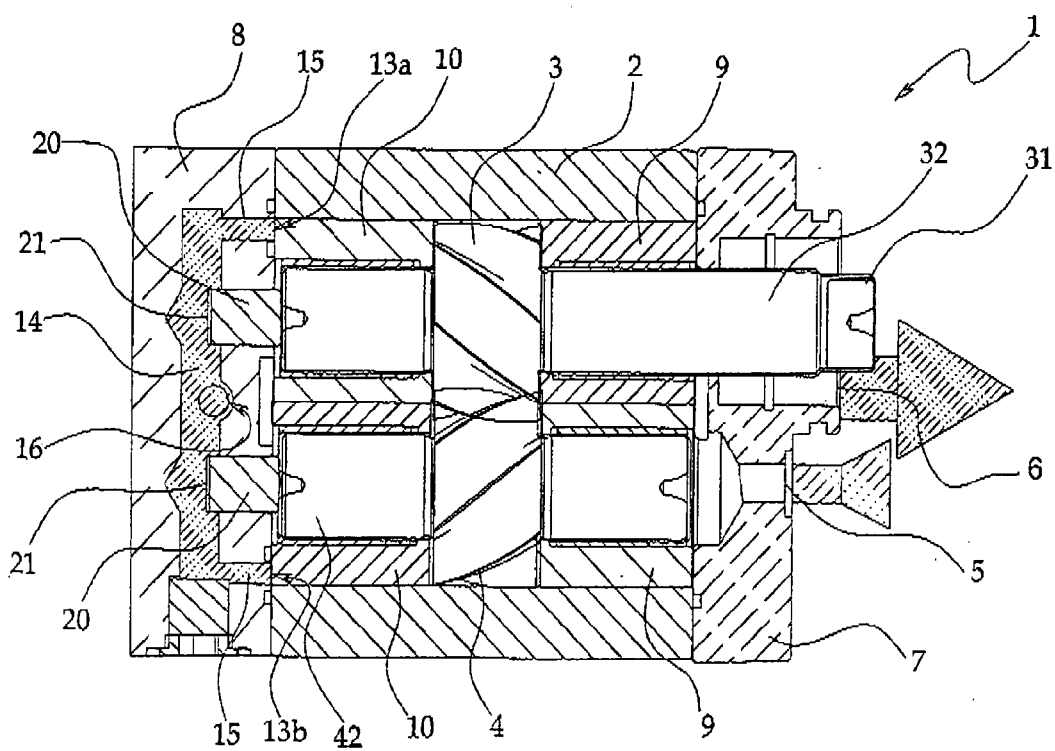


FIG.4

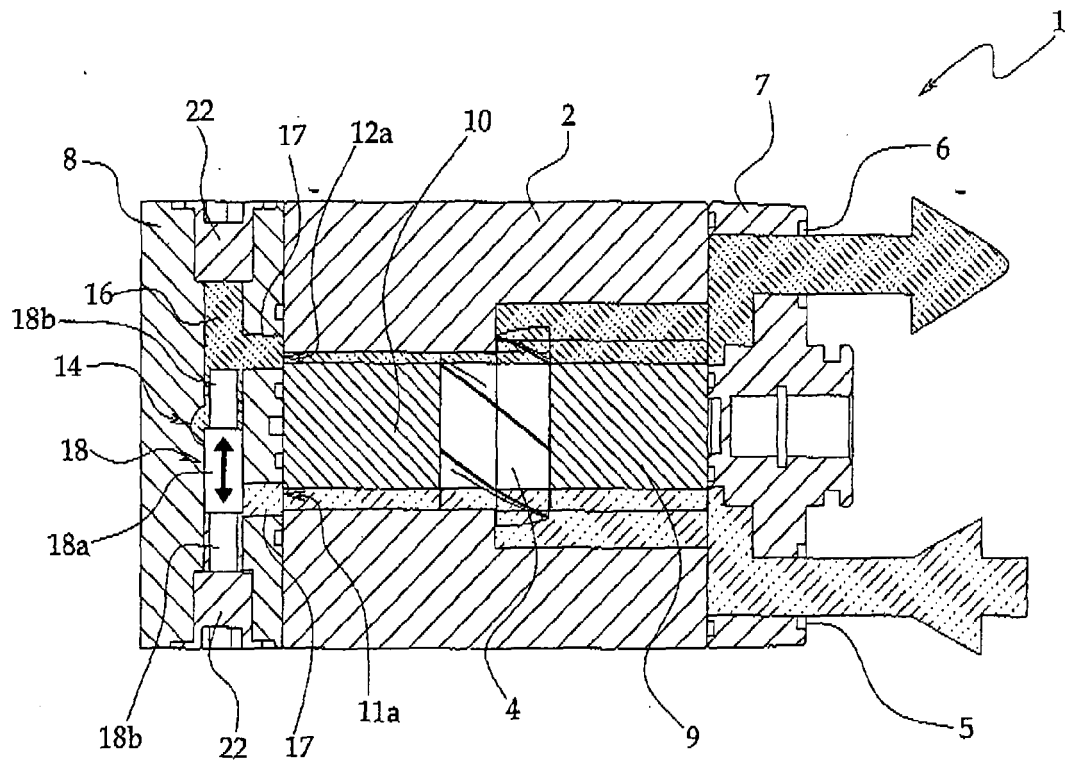


FIG.5

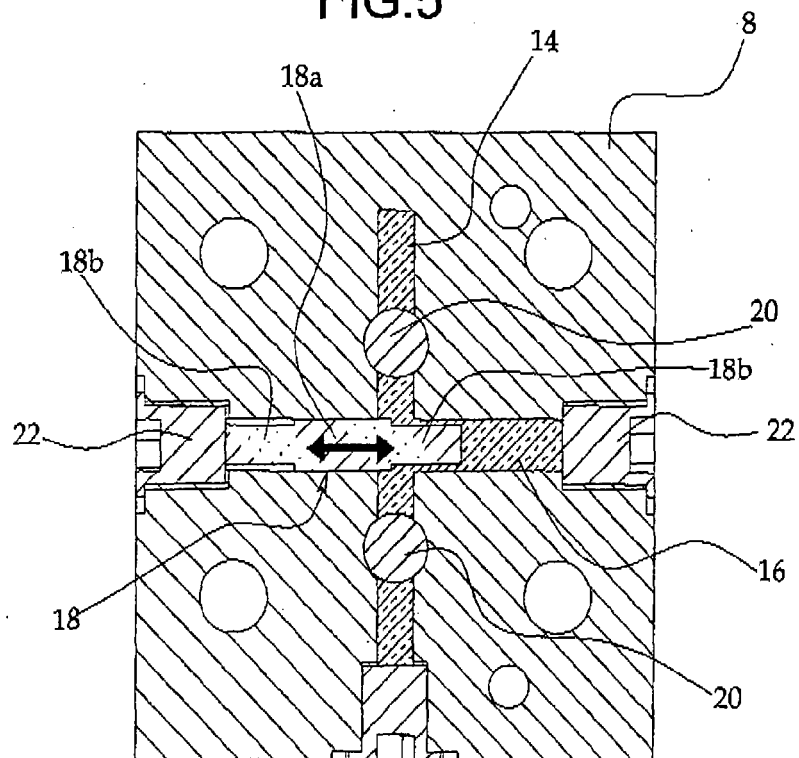


FIG.6

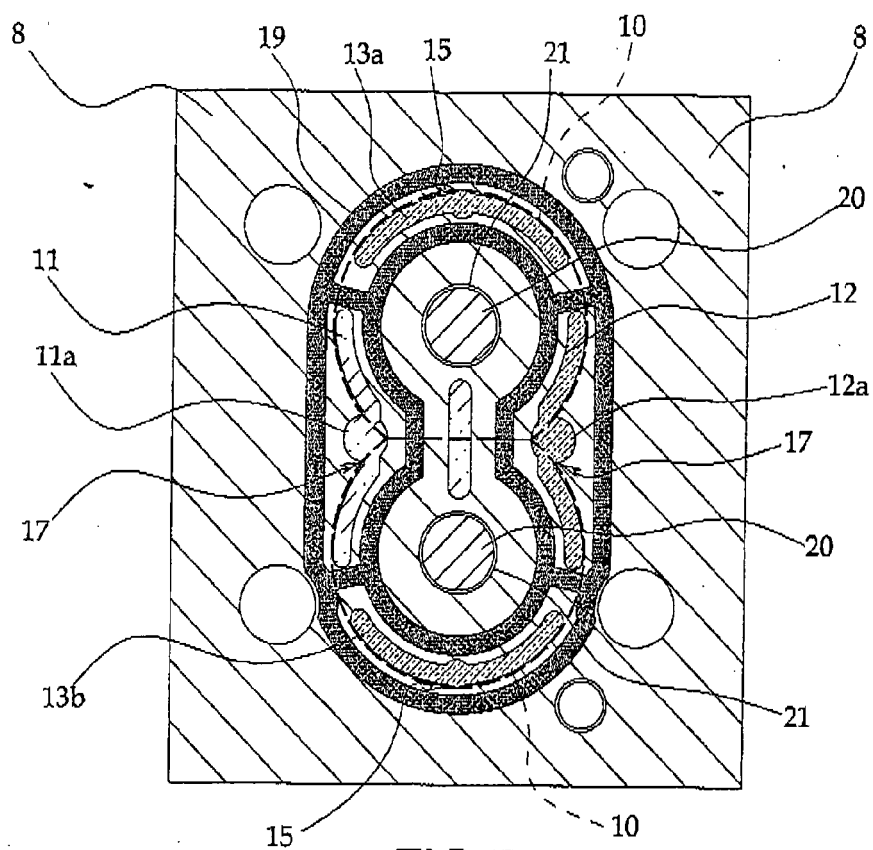


FIG.7

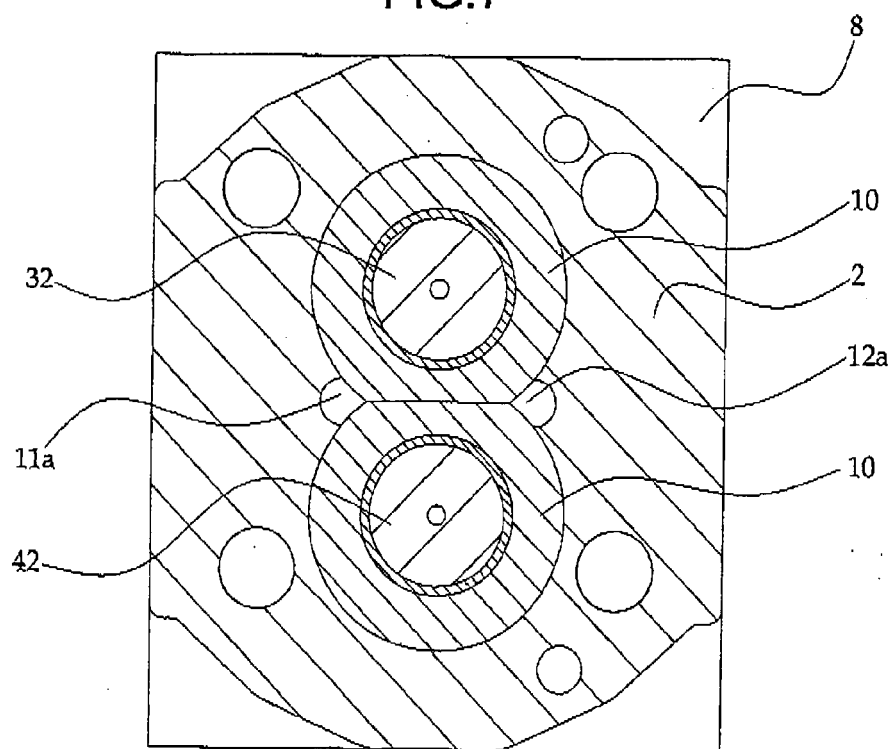


FIG.8



EUROPEAN SEARCH REPORT

Application Number
EP 09 01 0090

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2 541 010 A (UNGAR GUSTAVE A) 6 February 1951 (1951-02-06) * column 4, line 50 - column 5, line 3; figures 10,12 *	1-14	INV. F04C2/16 F04C15/00
A	GB 965 470 A (BOSCH GMBH ROBERT) 29 July 1964 (1964-07-29) * page 2, right-hand column, line 76 - line 106; figure 2 *	1-14	
A	EP 1 132 618 A (MORSELLI MARIO ANTONIO [IT]) 12 September 2001 (2001-09-12) * paragraph [0016]; figures 1,2 *	1-14	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F04C
Place of search		Date of completion of the search	Examiner
Munich		2 November 2009	Descoubes, Pierre
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

2
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 01 0090

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-11-2009

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2541010	A	06-02-1951	NONE	

GB 965470	A	29-07-1964	CH 393929 A	15-06-1965
			DE 1264958 B	28-03-1968

EP 1132618	A	12-09-2001	AT 393882 T	15-05-2008
			DE 60133786 T2	25-06-2009
			DK 1132618 T3	25-08-2008
			ES 2306681 T3	16-11-2008
			IT B020000119 A1	10-09-2001

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82